

Field Evaluation of Vegetative Debris Removal Techniques within the Circular Holding Tanks at the Tracy Fish Collection Facility

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Summary

The U.S. Bureau of Reclamation (Reclamation) has an active fish collection research program at Tracy Fish Collection Facility (TFCF), California, aimed at improving fish salvage operations. As part of these operations, research towards the improvement in current fish guidance through TFCF, fish salvage, and reintroduction of the salvaged fish into Sacramento-San Joaquin Delta waters are of great importance.

Aquatic debris loads entering TFCF have impaired fish salvage efficiency (Boutwell and Sisneros 2006). Debris which includes aquatic plants, woody material, and shells travels through the facility and potentially collects in the cylindrical holding tanks. This debris can affect the guidance of fish to the holding tanks, and may be detrimental to salvaged fish held in the holding tanks. While low debris loads do not cause extensive fish damage (Karp and Lyons 2008), high debris loads cause the fish haul-out bucket to become clogged and cause extensive damage to the fish (Brent Bridges, personal communication.). Studies on debris removal using a traveling screen in the secondary channel designed to remove Chinese mitten crabs (*Eriocheir sinensis*), while allowing fish passage through the screen, have been conducted (Boutwell and Sisneros 2006, Boutwell et al. 2008, Sisneros et al. 2009). The effectiveness of this screen to remove various types of debris appears to be limited, with small debris, less than 101 mm in length, often passing through the traveling screen into the circular holding tanks.

In order to reduce the debris loads entering the holding tanks, a series of facility improvements are planned for the next few years. TFCF installed a new trashrack cleaning system in 2010. In addition, the secondary louver system will be replaced with a Hydrolox traveling screen in FY 2012 or FY 2013 (Hydrolox Engineered Polymer Screens, Harahan, Louisiana.). A similar screen is planned to replace the primary louvers by 2015. It is anticipated that these facility improvements will likely reduce debris loads and composition of debris entering the holding tanks. However, installation of all these new systems is not expected until 2015 (Brent Mefford, personal communication). Therefore, debris accumulation in the holding tanks will remain an issue until the installation of the new facility components is complete. In addition, it is not known if the new systems will adequately reduce debris in the holding tanks even after installation.

This study (FY 2011) is Phase 2 of the vegetative debris removal techniques study that began in FY 2010. In Phase 1, a prototype traveling screen was developed, and laboratory testing is currently in progress at Reclamation's Hydraulics Laboratory in Denver, Colorado. Phase 2 consists of (1) building a version of the laboratory-tested traveling debris screen to fit the fish holding tanks at the Tracy facility and (2) testing of this traveling debris screen under standard operating conditions at Tracy. Depending on the results of the field testing, the screen can be immediately implemented upon completion of the study, and can also be used after the new systems are installed. The debris composition within the circular holding tanks is generally aquatic macrophytes such as Brazilian elodea (*Egeria densa*) and woody debris. The traveling screen was designed to remove as much debris, such as aquatic macrophytes, from the holding tank as possible with Brazilian elodea and other similar aquatic macrophytes being the target debris type. The screen would only be used when huge amounts of *Egeria densa* enter the holding tanks. Debris removed from the tank would be collected in a trash bin in the holding tank facility.

A physical model of one of the Tracy circular holding tanks was constructed in Reclamation's Hydraulics Laboratory in Denver, Colorado (Portz 2007). In FY 2010, this model has been used in the study to examine the performance of a prototype traveling screen for debris removal in the holding tanks. Testing is on-going at this time with results expected by the end of FY 2010. In FY 2011, this phase of the study will focus on building a full-scale model of the prototype traveling screen based on the results of the laboratory testing followed by installation and testing in the field at the Tracy facility. The methodology for testing in the field will match that used in the laboratory phase as much as possible while accommodating normal Tracy Facility operations.

Problem Statement

Aquatic debris often accumulates within the circular holding tanks and becomes a detriment to salvaged fish both in the holding tanks and within the fish hauling truck. At times the debris is so dense that it fouls the haul-out bucket that transfers the fish from the circular holding tank to the hauling truck, as well as the tank outlet to the fish-haul truck. A small, automated debris screen that could be placed within the circular holding tank to remove this debris would be of benefit to the salvaged fish by removing the debris within the holding tanks and thus exposing them to less risk.

Goals and Hypotheses

Goals:

1. Design a small traveling screen that can easily be used to remove common aquatic debris (both floating and submerged) from the TFCF circular holding tanks without causing harm to the fish.

Hypotheses:

1. Can an efficient traveling screen be designed and implemented within the circular holding tanks?

Ho: The traveling screen does not have an effect on the amount of debris contained in the holding tank, or does not remove a significant amount of debris from the holding tank.

Ha: The traveling screen does have an effect on the amount of debris contained in the holding tank, or does remove a significant amount of debris from the holding tank.

2. Do differing water velocities during which the traveling screen is used affect its ability to collect debris?

Ho: The velocities used when the traveling screen is in place does not have an effect on the amount of debris removed from the holding tank.

Ha: The velocities used when the traveling screen is in place does have an effect on the amount of debris removed from the holding tank

3. Can the traveling screen be implemented without causing detrimental effects to fish held in the holding tank?

Ho: The traveling screen does not have an effect on the survival of fish contained in the holding tank.

Ha: The traveling screen does have an effect on the survival of fish contained in the holding tank.

Materials and Methods

1. Statistical design for Phase 1, laboratory testing of prototype traveling debris screen includes the following. Test the screen at two different water velocities and three different positions (near the outside perimeter of the tank, in the center of the outside diameter and finally, next to the center core of the circular holding tank) within the fish holding tank model. Two (2) water velocities + 3 screen positions = 6×8 repetitions = 48 total runs.

2. Results of the laboratory testing and lessons learned through the course of 48 trial runs will be used in the design of the field prototype traveling screen. Modifications to the design and improvements will be implemented to address such issues as entrapment of debris on the edges of the screen, or others that become apparent as testing proceeds.

3. The field tests at TFCF will be conducted using the same statistical design as the laboratory tests but with possible modifications required due to the constraints of standard operating procedures at the facility.

Coordination and Collaboration

This second phase of the study is a collaborative effort with Denver's Hydraulic Investigations, Laboratory Services Group, the Fisheries and Wildlife Resources Group and the Biology and Maintenance staff at the TFCF. The Fisheries and Wildlife Resources Group provides a diverse range of expertise including knowledge of aquaculture and fish biology. These groups will work together in a bio-engineering approach to solving the challenge of designing and implementing a small, automated debris screen for use at the TFCF. We will coordinate with the state pumping facility, Harvey O. Banks Pumping Plant (BMP), to share information resulting from these experiments. Resource agencies will be contacted if traveling screens are recommended for prototype installation. Close coordination with the Biology and Maintenance staff at the TFCF will be maintained in order to fine-tune design and testing of the debris screens.

Endangered Species Concerns

Incidental "take" of any ESA listed salmon, steelhead, and Delta smelt is possible under normal operating procedures at TFCF and any wild sensitive species will be returned to Delta waters as quickly as possible. The total number of ESA species incidentally caught or collected during this research will be sent to the reporting agencies. Incidental take from this research will be covered under the TFCF Section 10 permit.

Dissemination of Results (Deliverables and Outcomes)

The primary deliverable will be a report published in the Tracy Volume Series. A progress report summarizing FY 2010 results for the circular holding tank traveling screen design, construction, and testing will be provided for review by September 2010. A draft Tracy Technical Report will be prepared on the finding of these studies for review in preparation of a volume for the Tracy Technical Report Series upon completion of these studies. Findings from this research (both laboratory and field evaluations) will also be presented to the Tracy O&M group and Tracy managers, with recommendations and procedures that can be undertaken quickly to improve the existing facilities ability to remove debris within the circular holding tank.

Data collected at the Hydraulics Laboratory and at the Tracy facility will be compiled into graphs and tables. This information will be presented as an assessment of the debris removal effectiveness of the traveling screen, and debris accumulation on the screen and conveyor system. Design and construction recommendations for a traveling screen will be based on evaluation of flow and debris removal of the circular holding tank debris. Any changes in facility operations and future design criteria will be made based upon the data gathered during this study.

Literature Cited

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